What to do if you get COVID

Practical tips to protect yourself from the long tail of risk

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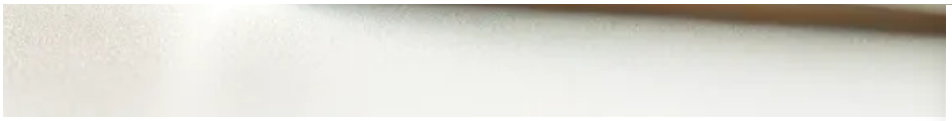

That moment you've been dreading has arrived (perhaps someone in your household woke up with a sore throat n and you did the swab. Double red line. Dammit.

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What to do now? "Pax and relax"? Sit it out and hope for normal business (as an increasingly alarming number of advising)? Is it really all down to a matter of good luck, g Not really. The available science says that there are diffe based on the choices they make *after* they get COVID, provided they move quickly.

In this post, we will share with you the things that we would do in that situation. A scientists who have been thinking a lot about SARS-CoV-2 (the virus that causes COVID) since the beginning of the pandemic, we have used our own research and academic backgrounds to inform our thinking on how to prepare ourselves and our loved ones to avoid the worst-case scenarios. Our thinking is guided by a simple heuristic — the longer the infection and the higher the viral load, the greater the ri of bad outcomes, the greater the risk of passing the disease on to others, and the greater the chance of contribution to further variant evolution. Although we bring a lot of different things that can be done, it's important to note that it's not all or nothing. The more you can implement, the better your chances.

It goes without saying that ***this is not medical advice*** (neither of us is a medical professional). It's an invitation for you to click on the hyperlinks, learn about the ris weigh your options, and make a plan for yourself. Hopefully, in walking you throug

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the thinking that we use in our daily lives, it inspires you to dry-run the scenario in your own mind, and lay out your own game plan, if you haven't already!

What happens in your body when you get infected with COVID

When SARS-CoV-2 makes a home in the body, it starts out with a localized infectio It takes a surprisingly small number of viral particles (or virions) to get an infection going — tens to hundreds. The virus spreads through the air like cigarette smoke, r as naked particles, but in tiny aerosolized particles of saliva and mucus. When it lar inside the nasal cavity, it binds to and enters the epithelial cells there. Interestingly the infection process takes quite a while — on the order of hours, apparently. While the site of initial infection was originally thought to be the nasal cavity, recent research has also implicated the cells of the buccal cavity (the mouth), in particular salivary glands.

In the early hours of an infection, the virus colonizes the cells of the first tissue whe it's established itself. As the viral load in this tissue builds up, the chances that it ca spread to other tissues increase. For an infection that is established in the nasopharynx, the virus has a relatively obvious path to the lungs. In the course of going about our daily lives, it turns out that we aspirate (breathe in) a tiny amount o saliva and mucosal fluids into our lungs, about two to four times an hour (this happ more often when we sleep). We ran the numbers on this mechanism, and it turns ou that this aspiration of saliva and mucosal fluids is sufficient to seed an infection in lungs. We now know that the epithelial cells of the mouth and salivary glands are al infected very early on, which provides a second potential source for virus-laden aspirates.

Viral colonization of the lungs is bad news in its own right, for obvious reasons. Th lungs are also a gateway to the blood- they provide a broad surface area of well-perfused tissue- some compare it to the size of a tennis court. This easy access to blood vessels allows the virus to make its way into the blood. This doesn't happen

often, but when it does, it's very bad news, causing damage to the heart, liver, kidne and other organs and significantly increasing the risk of death. Once it makes its w into the blood vessels, the virus also causes tiny blood clots throughout the body, which increase the risk of lung embolisms, heart attacks and strokes.

Virus-infected saliva is also swallowed, and the virus often sets up shop in the gut. This gut colonization is another potential complication, as once in the gut, the viru can persist there for months, or even years.

In some cases, the initial viral infection in the nasal cavity leads to infection of the brain via the trigeminal nerve. Viral colonization of the brain is particularly concerning, as the brain is immunologically privileged. (While that sounds like a go thing, it's really not!) What this means is that immune cells have a harder time getti into the brain. As a result, the virus is free to spread within the brain, and autopsies patients who died with severe COVID show the presence of replicating virus throughout the brain. Disconcertingly, even mild (non-hospitalized) cases of COVI can lead to physical changes to the brain that are visible on MRIs, accompanied by persistent cognitive impairment, reduced attention span, memory deficits, and othe neurological complications. These changes usually resolve over time, but in some cases have been shown to be progressive.

The other thing to consider is that the virus evolves within someone who is infecte This intrahost evolution is bad news for the patient, because it tips the balance of power in favor of the virus, making it harder for the infection to be cleared the long it persists. It's also bad news for us at a population level, because it makes it easier the virus to evade vaccines. In fact, a growing body of evidence points to intrahost evolution during long-term infections as being the primary driver of viral evolution this point. (We will dig into the implications of this intrahost viral evolution for individuals and the population a lot more in the next couple of weeks, so keep an ey out for that!)

Now, it's entirely possible that there are other mechanisms of spread — for exampl

the virus could enter the bloodstream directly from the oral cavity, or it could sprea by forming syncytia, tunneling between tissues as it spreads. The exact sequence of events and mechanism doesn't matter as much during the early stages of the diseas it stands to reason that the greater the viral population within the body, the greater risk of spread.

And here's the thing- the more widely the virus spreads, the more opportunities it h to do damage, and the greater the likelihood that the virus will not be eradicated by the immune system. Persistent SARS-CoV-2 infections are commonplace, can last f months, can happen even after a mild or asymptomatic case of COVID, can themse be near-asymptomatic, and do not require you to be immunocompromised. It's thus important to understand that the mildness of an acute case of COVID is *not* a meas of what damage it's doing.

COVID is not a cold, it's a car accident. It spreads silently through the body, leavin trail of damage in its wake — the harm caused to your body may not be immediatel visible at first. Most people get out of car accidents with nary a scratch, but get inte enough accidents and your luck may run out. If you know that you're infected, it's important to immediately take steps to deal with the infection.

What we would do if we had COVID

Okay, so coming back to the scenario, let's say that one of us woke up with a sore throat and tested positive (or even before then, given the risk of false negatives on rapid antigen tests). What would we do?

1. **Reduce viral load at the site of infection.** In practical terms, when infected wit COVID, the best bet is to try to keep it from spreading from the initial site. Th lower the overall viral load, the less likely the virus is to spread widely. Also, th lower the viral load, the fewer chances the virus has to evolve. Because the initi infection sites are accessible from the outside of the body (topologically speaki they are tractable to being bathed in liquids that provide a hostile growth

environment for the virus. For example, studies show mouthwashes can reduce viral load, with some limited clinical data as well. Nasal sprays, based on gener regarded as safe (GRAS) ingredients, are also worth looking into. Although clin approvals for these agents varies by country, iota-carrageenan has showed initi promise in reducing the risk of infection. Nitric Oxide sprays have also been shown to reduce virus levels more quickly in patients (as shown in clinical stud from England and India). Some studies have also showed an effect of saline rins in reducing viral load at the infection site. Obviously, the clinical data for these agents is limited, and they're not approved in every country, but hopefully the links here can get you started with looking into your options.

2. **Mitigate the potential risk of spread to other organs.** There is a fair bit of clin data supporting the idea that probiotics can lead to better clinical outcomes fo COVID infections. Metformin, a widely available and well-tolerated oral diabe drug, has been shown in some clinical trials (but not others) to reduce viral loac improve survival, and modestly decrease the risk of Long COVID. Some clinica results (but not others) suggest that Paxlovid may also reduce the risk of Long COVID. Other agents exist out there, and the keys when evaluating their suitability are their efficacy and toxicity upon repeated use. Speaking for ourselves, in situations where family members have been infected, they've used combination of low-toxicity agents, repeatedly throughout the day, to bring do the viral load as quickly as possible.
3. **Get plenty of rest.** COVID infections dramatically increase the risk of delayed heart attacks, strokes and embolisms both during and after an infection (even a mild one), potentially because of microclots in the body. Be sure to take it as ea as possible during the infection, and ease into exercise slowly (wait several mor if possible). Rest also seems to reduce the risk of Long COVID.
4. **Take steps to reduce the spread of COVID within the household.** Move quickl after a positive test to limit within-household spread from patient zero. It can b done! (We've done it ourselves more than once). Risk of infection scales almost

linearly with time and proximity, so it's not all or nothing. Every little bit helps!

a. **Improve indoor air quality**: A number of studies have linked indoor air qua to risk of spread within a household. The virus spreads like cigarette smoke so the six-foot rule doesn't apply. If you have an infection in the house, whe possible, try to isolate each person in a different bedroom. If weather perm stick a box fan in each window. Set it up so that the air vents outwards fron the infected person's room (source control), but inwards for the others. Ope windows and/or use portable HEPA filters to try to get to five air changes p hour or better in common spaces. If you have an extra HEPA filter (or Corsi Rosenthal Box) place it in the infected person's room (again, source control) you have a house fan or a kitchen vent fan with a high volume of air moved, turn it on. Turn off forced air central heating/ air conditioning (unless you have a HEPA filter inline) and consider using weather strips to isolate the a in the bedrooms from each other. The goal is to set up so that each person c be unmasked in their bedroom, while having a high enough airflow in common spaces so that it's still safe with a mask on. Read our recent post fo more on this topic.

b. **Test and isolate everyone.** If one person in the house is infected, it's best to assume that everyone is potentially infected. Thus, it's important to isolate everyone from each other until they clear their exposure to the last person w was infected. (Typically, one week since the last positive test from the last person in the household who was infected). If you have symptoms, it's important to remember that symptoms can be present for several days befo the tests show positivity. Rapid antigen tests are readily available, but have problem with false negatives. Newer PCR-grade tests, based on LAMP technology are far more accurate, but can be expensive ($20-65/test, readers usually cost extra).

c. **Wear a mask**. Use N95 (or better) respirators in common spaces- it leads to robust reduction in risk of infection, no matter what the Cochrane study (lo

says!

What's the logic here?

There is no universe in which harboring fewer actively replicating viral particles within your body is going to lead to a worse outcome for one's health than having more. By hitting the body hard with multiple different "debulking" agents, we achie four outcomes:

- Reducing the likelihood of viral spread within the body- we can assume that spread by diffusion throughout the body is less efficient when the total numbe virions is lower.
- Reducing the rate at which the virus evolves within the body- more virus mean more evolution.
- Giving the immune system time to play catch-up. It takes several days for B cel to crank up antibody production, while the viral infection is at full speed in the first few days. Slowing down the rate of virus production can buy your immune system time.
- Reducing the risk of viral spread to other members within the household. Less virus in patient zero means less virus to spread around.

This is a lot of information to digest at once, but we're putting it out there in hopes helping you plan out a practical course of action. Hopefully you never have to use th information here, of course! But if the evil moment arrives, remember that it's not a or nothing — the more steps you implement, the better your chances of avoiding ba outcomes with COVID.

Epilogue: some handy tips

Here are some other small tips to chew on, while formulating your plans:

- Consider using a CO2 monitor to evaluate the quality of your ventilation at hor

(we discussed this last week).

- Keep a pulse oximeter handy — lung complications remain a threat for acute COVID, especially with the elderly. (Keep in mind that pulse oximeters overestimate oxygen saturation if you have darker skin, so consider establishing your own baseline ahead of time if this applies to you.)
- Write out your COVID "fire drill" ahead of time, and make sure everyone in the family understands it. This saves time and reduces stress in the event of a posit
- Have a "go bag" pre-packed, if the plan is for people to isolate at a different location. Again, saves time and reduces stress.

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A guest post by

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I am a professor of evolutionary biology in Canada. My academic interests include genome size evolution, evolutionary theory, science education, scientific communication, and SARS-CoV-2 evolution.

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